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Memo

DATE: *January 24, 2003*

TO: RHIC E-Coolers

FROM: *Ady Hershcovitch*

SUBJECT: **Minutes of the January 24, 2003 Meeting**

Present: Ilan Ben-Zvi, Xiangyun Chang, Gregory Citver, Michael Harrison, Ady Hershcovitch, Michael Iarocci, Jorg Kewisch, Derek Lowenstein, William Mackay, Christoph Montag, Thomas Roser, Triveni Srinivasan-Rao, Dejan Trbojevic, Dong Wang.

Topics discussed: Simulation & Calculations, Measuring Electron and Ion Temperatures in the Solenoid, Damping Cavity Higher Order Modes.

Simulation & Calculations: Jorg opened the meeting with a description of options for the break in the cooling solenoid. Previously the number of needed breaks was not clear. After a meeting that Jorg had with Animesh, Mike Harrison, Mike Iarocci, and Christoph, the present scenario is for the solenoid to consist of two 12.5 meter sections, i.e., one break. The solenoid field is 10 kG. To prevent cyclotron motion, and hence excitation of Larmor circles, Jorg showed two options for matching the two sections. One option is based on a paper by Derbenev, in which a 15 kG 25 cm long solenoid is inserted between the two sections. Between this magnet and each of the cooling solenoid sections there is a 20 cm gap. The other option shown by Jorg was the addition of a 15 kG 25 cm long coil at the end of each solenoid section with a 40 cm gap between them.

A short discussion ensued regarding the merit of additional variable power supplies for energizing the additional coils. Jorg claimed that Christoph has a tracking program, with which the need for separate power supplies can be tested by monitoring the effect of a 5% variation.

Mike Harrison pointed out that the preferred choice is a variation on the second option, in which there is a double layer of windings at the end that generates a 20 kG field. Waldo asked if additional power supplies could be used to separately power the extra layers of windings and whether the two solenoid sections can be brought close to a point where they touch. Mike Harrison replied that although it is preferable to power the extra windings with the same power supply, it is possible to power them separately by bring out additional leads. The gap between the solenoid sections is determined by physical piping considerations. It has to be 40 cm minimum. It can be made larger but the end solenoids must be made stronger or longer. Waldo asked about heating effects due to the correction coils. Mike's reply was that the overall thermal load is 5 kW, which can be easily handled by the 55 kW cooling capability. However, there could still be a localized heating problem. Ilan asked if the correction coils could be made superconducting to prevent the heating problem. Mike answered that superconducting magnets do not run well at the low currents needed by the correction coils.

Measuring Electron and Ion Temperatures in the Solenoid: Ilan presented some ideas for measuring electron and ion temperatures in the cooling solenoid. These measurements are needed for optimizing the magnetic field. Since the cooling time is long, a faster measurement is needed. Ilan showed three preliminary schemes:

1. CALM beam monitor, which detects ions lost to recombination. Recombination is very sensitive to the relative velocity between the ions and electrons, the quantity that we want to measure.
2. Match longitudinal velocities by measuring x-rays from Compton scattering.
3. Measure transverse location by bouncing a laser beam off the internal solenoid wall. It must be performed with a short-pulsed laser to intercept the beam only once.

Regarding previous electron beam coolers Ilan claimed that measurement were not possible since their gamma was too low. Waldo pointed out that since the RHIC circumference is known within a mm, ion energy could be determined within 10^{-3} from the revolution frequency. For the third scheme, concern of mirror charging up was raised. Triveni suggested using metal deposits on inner magnet wall.

Damping Cavity Higher Order Modes: Dong showed results of calculations designed to simulate placement of ferrite mode absorbers in the superconducting cavity and their affects on higher order modes. By properly shaping and positioning ferrite absorbers, Dong showed great improvement of higher order damping. The Q of the cavity is about 10^{10}. Six modes in the range of 877.3 – 1016 MHz were damped to Q's of 10^5, 10^4, and 10^2, with the lower Q's at the higher modes. To Mike Harrison's question regarding heat deposition into the ferrites, Dong's answer was 10's of Watts.

Reminder: Dave Bruhwiler from TECH-X is scheduled to give a presentation at our next (January 31st, 2003) meeting.